Listing of Claims:

Claims 1-11 (Canceled).

12. (Currently Amended) A radar device ~~characterized by~~ comprising:

a transmitting unit which ~~radiates~~ is configured to radiate a radar pulse into a space via a transmitting antenna;

a receiving unit which ~~receives~~ is configured to receive via a receiving antenna a reflected wave of the radar pulse returned from the space;

an analysis processing unit which explores an object existing in the space based on a reception output from the receiving unit; and

a control unit which controls at least one of the transmitting unit and the receiving unit based on an output from the analysis processing unit,

wherein each of the receiving antenna and the transmitting antenna ~~are configured by first circularly polarized type of antenna elements having a predetermined polarization rotation direction and second circularly polarized type of antenna elements having a polarization rotation direction in a direction opposite to the predetermined polarization rotation direction,~~

~~the first and second circularly polarized type of antenna elements each comprising~~ comprises:

a dielectric substrate;

a ground conductor which is piled up at one surface side of the dielectric substrate;

~~a~~ a circularly polarized ~~type of~~ antenna ~~element~~ elements formed onto an opposite side of the dielectric substrate;

a plurality of metal posts ~~whose respective one end sides are connected to the ground conductor and penetrate~~ which are arranged at predetermined intervals into a lattice structure to have cavities, the metal posts surrounding the antenna elements which are arranged in the cavities, respectively, wherein each of the metal posts has one and opposite ends, and penetrates the dielectric substrate along a thickness direction thereof, the one ends of the metal posts being connected to the ground conductor, and ~~whose respective other end sides extend up to the opposite surface of the dielectric substrate,~~ the opposite ends of the ~~plurality of~~ metal posts ~~configuring cavities by~~ being ~~provided at predetermined intervals so as to surround~~ arranged around the antenna ~~element~~ elements on the opposite surface of the dielectric substrate; and

a conducting rim which ~~short-circuits~~ is extended along an arrangement of the opposite ~~respective other end sides of the~~

~~plurality~~ ends of the metal posts to define the cavities, and which is connected to the opposite ends of the metal posts to short-circuit the metal posts;

wherein the circularly polarized antenna elements for the receiving antenna are electrically isolated from the circularly polarized antenna elements for the transmitting antenna, and wherein the circularly polarized antenna elements for the receiving antenna have a first polarization rotation direction, and the circularly polarized antenna elements for the transmitting antenna have a second polarization rotation direction opposite to the first polarization rotation direction.

~~along array directions thereof, and is provided so as to extend by a predetermined distance in the direction of the antenna element at the opposite surface side of the dielectric substrate,~~

~~the plurality of metal posts, whose respective one end sides are connected to the ground conductor and penetrate the dielectric substrate along a thickness direction thereof, and whose respective other end sides extend up to the opposite surface of the dielectric substrate, respectively configure isolated cavities by being provided at predetermined intervals so as to surround the first circularly polarized type of antenna elements and the second circularly polarized type of antenna elements in isolation, and~~

~~as the conducting rim, a first conducting rim and a second conducting rim, which short-circuit the respective other end sides of the plurality of metal posts which are respectively provided at predetermined intervals so as to surround the first circularly polarized type of antenna elements and the second circularly polarized type of antenna elements in isolation along array directions thereof, are provided on the opposite surface side of the dielectric substrate so as to extend by a predetermined distance in the directions of the first circularly polarized type of antenna elements and the second circularly polarized type of antenna elements.~~

13. (Currently Amended) The radar device according to claim 12, ~~characterized in that~~ wherein:

each of the antenna ~~element~~ elements ~~has a predetermined polarization rotation direction, and~~ is formed of a square-shaped spiral type or a circular spiral type having a central ~~side~~ end portion ~~of a spiral~~, and

~~the radar device~~ each of the receiving antenna and the transmitting antenna further comprises ~~a~~ plural feed ~~pin whose~~ pins, each feed pin having one end ~~side is~~ connected to the central ~~side~~ end portion of the ~~spiral of the~~ corresponding antenna element ~~formed of the square-shaped spiral type or circular spiral type~~, and wherein each of the feed ~~pin being~~

~~provided~~ pins is extended in the corresponding dielectric substrate and is so projected from the one surface side of the corresponding dielectric substrate as to ~~penetrate the dielectric substrate and~~ be electrically isolated from the corresponding ground conductor.

14. (Currently Amended) The radar device according to claim 13, ~~characterized in that~~ further comprising:

~~the antenna element which is formed on the dielectric substrate and the feed pin whose one end side is connected to the central side end portion of the spiral of the antenna element are provided to be respectively in plural sets,~~

~~the predetermined polarization rotation directions of the plural sets of antenna elements are respectively formed so as to be identical polarization rotation direction,~~

~~the plurality of metal posts configuring the cavities and the conducting rim are formed in a lattice shape so as to surround the plural sets of antenna elements, and~~

~~the radar device further comprises~~ a feed unit to distribute and supply excitation signals to ~~the plural sets of~~ antenna elements via ~~the plural sets of~~ respective feed pins, the feed unit being provided at a ground side ~~of the ground conductor~~.

15. (Currently Amended) The radar device according to claim 14, ~~characterized in that~~ wherein the feed unit ~~is configured by~~ includes:

a feeding dielectric substrate provided at a side opposite to ~~the~~ a given dielectric substrate so as to sandwich ~~the~~ a given ground conductor, and

a microstrip type of feeding line formed on a surface of the feeding dielectric substrate.

16. (Currently Amended) The radar device according to claim 14, ~~characterized in that~~ wherein the antenna elements of each of the receiving antenna and the transmitting antenna comprise first and second antenna elements, and wherein:

the ~~plural sets of~~ first antenna elements are ~~formed so as to have at least two types of different array angles of identical~~ arranged at a same first array angle ~~and different array angles from one another respectively~~ around axes perpendicular to the opposite surface of the dielectric substrate, and the second antenna elements are arranged at second array angles different from the same first array angle around axes perpendicular to the opposite surface of the dielectric substrate, respectively, and ~~among the plural sets of antenna elements, the feed unit distributes and supplies the excitation signals among the~~

~~respective antenna elements having the identical array angle in-phase, and distributes and supplies~~

the excitation signals include first and second excitation signals which are supplied to the first and second antenna elements through the respective feed pins, the first excitation signals exciting the first antenna elements to produce main polarization components which are in-phase and cross polarization components which are in-phase, and the second excitation signals exciting the second antenna elements to produce ~~among the respective antenna elements having the different array angles such that respective~~ main polarization components which are in-phase and ~~respective~~ cross polarization components which are ~~out of phase~~ out-of-phase.

17. (Currently Amended) The radar device according to claim 13, ~~characterized in that~~ wherein the antenna ~~element~~ elements are formed ~~of the~~ in the square-shaped spiral ~~type is formed as a square-shaped spiral type of antenna element~~ with a predetermined number of turns ~~which are~~ interlinked with one another ~~in a square-shaped spiral form configured such that~~, each turn having a conductive line arranged at an angle of 90° and ~~assuming that a basic length is a0 with a predetermined element width W, lines~~ having ~~lengths~~ a length of ~~the~~ a0 ~~and~~ or an integer ~~multiples~~ multiple of ~~the~~ a0, wherein a0 is a basic

length having a predetermined element width W ~~are arranged at each angle of 90°~~.

18. (Currently Amended) The radar device according to claim 13, ~~characterized in that~~ wherein the antenna ~~element which is~~ elements are formed ~~of the circular spiral type is formed as a~~ in the circular spiral ~~type of antenna element having~~ with a predetermined number of turns ~~which are~~ interlinked with one another, the ~~in a~~ circular spiral ~~form with~~ having a predetermined element width W at a predetermined spiral interval d, and ~~with~~ a predetermined radius initial value SR from a reference point.

Claims 19 and 20 (Canceled).

21. (New) A circularly polarized antenna comprising:

a dielectric substrate;

a ground conductor which is piled up at one surface side of the dielectric substrate;

a plurality of circularly polarized antenna elements which are arranged and formed on an opposite surface of the dielectric substrate, wherein the antenna elements have a same predetermined polarization rotation direction, and each of the antenna elements

is formed into a square-shaped spiral or a circular spiral having a central end portion;

an array of metal posts which are arranged at predetermined intervals into a lattice structure to have cavities, the metal posts surrounding the antenna elements which are arranged in the cavities, respectively, wherein each of the metal posts has one and opposite ends, and penetrates the dielectric substrate along a thickness direction thereof, the one ends of the metal posts being connected to the ground conductor, and the opposite ends of the metal posts being arranged around the antenna elements on the opposite surface of the dielectric substrate;

a conducting rim which is extended along an arrangement of the opposite ends of the metal posts to define the cavities, and which is connected to the opposite ends of the metal posts to short-circuit the metal posts;

feed pins each having one end connected to the central end portion of the corresponding antenna element, wherein each of the feed pins is extended in the dielectric substrate and is so projected from the one surface side of the dielectric substrate as to be electrically isolated from the ground conductor;

a feeding dielectric substrate provided at a side opposite to the one surface side of the dielectric substrate so as to interpose the ground conductor between the feeding dielectric substrate and the dielectric substrate; and

a microstrip feeding line which is formed on the feeding dielectric substrate and which is connected to the feed pins, wherein excitation signals are supplied to the antenna elements through the feeding line and the feed pins.

22. (New) The circularly polarized antenna according to claim 21, wherein a given cavity and the conducting rim defines a cavity configure resonator which is excited by the circularly polarized antenna at a predetermined resonant frequency, and wherein the circularly polarized antenna has a frequency characteristic that provides a sufficient antenna gain in an operation frequency band and a notch in which an antenna gain declines within a predetermined range that includes the resonant frequency.

23. (New) The circularly polarized antenna according to claim 22, wherein the given cavity and the conducting rim have parameters, respectively, which provide the predetermined resonant frequency, the parameters including at least one of an inside dimension L_W of the given cavity, a rim width L_R of the conducting rim, a number of turns of the corresponding antenna element, a basic length a0 of the corresponding antenna element, and a line width W of the corresponding antenna element.

24. (New) A circularly polarized antenna comprising:

a dielectric substrate;

a ground conductor which is piled up at one surface side of the dielectric substrate;

a plurality of antenna elements which are arranged and formed on an opposite surface of the dielectric substrate, wherein each of the antenna elements is formed into a square-shaped spiral or a circular spiral having a central end portion, wherein the antenna elements include first and second groups of antenna elements, the antenna elements in the first group being arranged at a same first array angle around axes perpendicular to the opposite surface of the dielectric substrate and the antenna elements in the second group being arranged at second array angles different from the same first array angle around axes perpendicular to the opposite surface of the dielectric substrate, respectively;

an array of metal posts which are arranged at predetermined intervals into a lattice structure to have cavities, wherein the metal posts surround the antenna elements which are arranged in the cavities, respectively, and wherein each of the metal posts has one and opposite ends, and penetrates the dielectric substrate along a thickness direction thereof, the one ends of the metal posts being connected to the ground conductor, and the opposite ends of the metal posts being arranged around the

antenna elements on the opposite surface of the dielectric substrate;

a conducting rim which is extended along an arrangement of the opposite ends of the metal posts to define the cavities, and which is connected to the opposite ends of the metal posts to short-circuit the metal posts;

feed pins each having one end connected to the central end portion of the corresponding antenna element, wherein each of the feed pins is extended in the dielectric substrate and is so projected from the one surface side of the dielectric substrate as to be electrically isolated form the ground conductor; and

a feed unit configured to supply first and second excitation signals to the first and second groups of the antenna elements through the feed pins, wherein the first excitation signals excite the first group of the antenna elements to produce main polarization components which are in-phase and cross polarization components which are in-phase, and the second excitation signals excite the second group of the antenna elements to produce main polarization components which are in-phase and cross polarization components which are out-of-phase.

25. (New) The circularly polarized antenna according to claim 24, wherein a given cavity and the conducting rim define a cavity configure resonator which is excited by the circularly

polarized antenna at a predetermined resonant frequency, and wherein the circularly polarized antenna has a frequency characteristic which provides a sufficient antenna gain in an operation frequency band and a notch in which an antenna gain declines within a predetermined range that includes the resonant frequency.

26. (New) The circularly polarized antenna according to claim 25, wherein the given cavity and the conducting rim have parameters, respectively, which provide the predetermined resonant frequency, the parameters including at least one of an inside dimension L_W of the cavity, a rim width L_R of the conducting rim, a number of turns of the corresponding antenna element, a basic length a0 of the corresponding antenna element, and a line width W of the corresponding antenna element.

27. (New) A circularly polarized antenna comprising:

a dielectric substrate;

a ground conductor which is piled up at one surface side of the dielectric substrate;

a circularly polarized antenna element formed on an opposite surface of the dielectric substrate in a square-shaped spiral with a predetermined number of turns interlinked with one another, each turn having a conductive line arranged at an angle

of 90° and having a length of a0 or an integer multiple of a0, wherein a0 is a basic length with a predetermined element width W;

an array of metal posts which are arranged at predetermined intervals, wherein the metal posts surround the antenna element to form a cavity, and wherein each of the metal posts has one and opposite ends, and penetrates the dielectric substrate along a thickness direction thereof, the one ends of the metal posts being connected to the ground conductor, and the opposite ends of the metal posts being arranged around the antenna element on the opposite surface of the dielectric substrate;

a conducting rim which is extended along an arrangement of the opposite ends of the metal posts to define the cavity, and which is connected to the opposite ends of the metal posts to short-circuit the metal posts; and

a feed pin having one end connected to a central end portion of the antenna element, wherein the feed pin is extended in the dielectric substrate and is so projected from the one surface side of the dielectric substrate as to be electrically isolated from the ground conductor.

28. (New) The circularly polarized antenna according to claim 27, wherein the cavity and the conducting rim define a cavity configure resonator which is excited by the circularly

polarized antenna at a predetermined resonant frequency, and wherein the circularly polarized antenna has a frequency characteristic which provides a sufficient antenna gain in an operation frequency band and a notch in which an antenna gain declines within a predetermined range that includes the resonant frequency.

29. (New) The circularly polarized antenna according to claim 28, wherein the cavity and the conducting rim have parameters, respectively, which provide the predetermined resonant frequency, the parameters including at least one of an inside dimension L_w of the cavity, a rim width L_R of the conducting rim, the number of turns of the antenna element, the basic length a0 of the antenna element, and the width W of the antenna element.

30. (New) A circularly polarized antenna comprising:

a dielectric substrate;

a ground conductor which is piled up at one surface side of the dielectric substrate;

first and second circularly polarized antenna elements formed on an opposite surface of the dielectric substrate, wherein the first circularly polarized antenna element has a first polarization rotation direction, and the second circularly

polarized antenna element has a second polarization rotation direction opposite to the first polarization rotation direction;

arrays of metal posts which are arranged at predetermined intervals into a structure to have cavities, wherein the metal posts surround the first and second antenna elements which are arranged in the cavities, respectively, and which are isolated from each other by the metal posts, and wherein each of the metal posts has one and opposite ends, and penetrates the dielectric substrate along a thickness direction thereof, the one ends of the metal posts being connected to ground, and the opposite ends of the arrays of the metal posts being arranged around the respective antenna elements on the opposite surface of the dielectric substrate; and

conducting rims which are extended along an arrangement of the opposite ends of the respective arrays of the metal posts, and which are connected to the opposite ends of the respective arrays of the metal posts to short-circuit the respective arrays of the metal posts.

31. (New) The circularly polarized antenna according to claim 30, wherein a given cavity and the corresponding conducting rim define a cavity configure resonator which is excited by the circularly polarized antenna at a predetermined resonant frequency, and wherein the circularly polarized antenna has a

frequency characteristic which provides a sufficient antenna gain in an operation frequency band and a notch in which an antenna gain declines within a predetermined range that includes the resonant frequency.

32. (New) The circularly polarized antenna according to claim 31, wherein the given cavity and the corresponding conducting rim have parameters, respectively, which provide the predetermined resonant frequency, the parameters including at least one of an inside dimension L_W of the given cavity, a rim width L_R of the corresponding conducting rim, a number of turns of the corresponding antenna element, a basic length a0 of the corresponding antenna element, and a line width W of the corresponding antenna element.

33. (New) A circularly polarized antenna comprising:

a dielectric substrate;

a ground conductor which is piled up at one surface side of the dielectric substrate;

a transmitting antenna for a radar device which includes a first group of circularly polarized antenna elements;

a receiving antenna for the radar device which includes a second group of circularly polarized antenna elements, wherein the first and second groups of the circularly polarized antenna

elements are formed on an opposite surface of the dielectric substrate, the first group of the circularly polarized antenna elements having a first polarization rotation direction, and the second group of the circularly polarized antenna elements having a second polarization rotation direction opposite to the first polarization rotation direction;

arrays of metal posts which are arranged at predetermined intervals into a structure to have cavities, the metal posts surrounding the antenna elements in the first and second groups which are arranged in the cavities, respectively, and which are isolated from each other by the metal posts, wherein each of the metal posts has one and opposite ends, and penetrates the dielectric substrate along a thickness direction thereof, the one ends of the metal posts being connected to ground, and the opposite ends of the arrays of the metal posts being arranged around the respective antenna elements on the opposite surface of the dielectric substrate; and

conducting rims which are extended along an arrangement of the opposite ends of the respective arrays of the metal posts and which are connected to the opposite ends of the respective arrays of the metal posts to short-circuit the respective arrays of the metal posts.

34. (New) The circularly polarized antenna according to claim 33, wherein a given cavity and the corresponding conducting rim define a cavity configure resonator which is excited by the circularly polarized antenna at a predetermined resonant frequency, and wherein the circularly polarized antenna has a frequency characteristic which provides a sufficient antenna gain in an operation frequency band and a notch in which an antenna gain declines within a predetermined range that includes the resonant frequency.

35. (New) The circularly polarized antenna according to claim 34, wherein the given cavity and the corresponding conducting rim have parameters, respectively, which provide the predetermined resonant frequency, the parameters including at least one of an inside dimension L_W of the given cavity, a rim width L_R of the corresponding conducting rim, a number of turns of the corresponding antenna element, a basic length a0 of the corresponding antenna element, and a line width W of the corresponding antenna element.

36. (New) The radar device according to claim 12, wherein a given cavity and the corresponding conducting rim define a cavity configure resonator which is excited by the corresponding circularly polarized antenna at a predetermined resonant

frequency, and wherein the corresponding circularly polarized antenna has a frequency characteristic which provides a sufficient antenna gain in an operation frequency band and a notch in which an antenna gain declines within a predetermined range that includes the resonant frequency.

37. (New) The radar device according to claim 36, wherein the given cavity and the corresponding conducting rim have parameters, respectively, which provide the predetermined resonant frequency, parameters including at least one of an inside dimension L_W of the given cavity, a rim width L_R of the corresponding conducting rim, a number of turns of the corresponding antenna element, a basic length a0 of the corresponding antenna element, and a line width W of the corresponding antenna element.